

What is claimed is:

1. A method for analyzing wine in a series of steps comprising

5 a) removing a ten to twenty micro-liter test sample of wine from a container of wine using a sampling device;

b) allowing the sample droplet to absorb into an adsorptive layer of a test strip after which the sample proceeds downward through an interference removal pad, then continues to a reagent test pad where it reacts with at least one colorimetric indicating  
10 material;

c) waiting from one to ten minutes for color development;

d) viewing the color that has developed by looking at a hole provided in a polymeric, non-reactive support that is pre-punched and pre-scored;

e) comparing the developed color to a standard color chart provided, making  
15 corrections to compensate for any dilution that was done;

f) using the color comparison chart to assay the wine source from which the sample was taken;

g) adjusting the wine source as desired for maximizing quality as indicated by color.

20 2. The method of claim 1 wherein analysis of the wine sample is for measuring the lactic acid level of wine that is undergoing malolactic fermentation lactic acid which includes the steps of

i) diluting the wine sample in a ratio of 1:10 if necessary to keep the lactic acid  
25 concentration of the test sample in the range of from zero to 400 mg/L;

ii) squeezing a sampler bulb;

iii) dipping the tip of the sampler tip into wine;

iv) releasing the bulb to aspirate sample;

v) transferring the sample to an adsorptive layer on the back of a test strip by  
30 squeezing the sampler bulb;

vi) allowing a sample droplet to absorb into adsorptive layer after which the sample proceeds downward through an interference removal pad, then continues to a reagent test pad where it reacts with at least one colorimetric indicating material;

vii) waiting about two minutes for color development;

5 viii) viewing the color developed ;

ix) determining the lactic acid level by comparing the developed color to a standard color chart provided, making corrections to compensate for any dilution that was done;

10 x) maximizing the quality of wine by inoculating for malolactic fermentation if lactic acid levels are low and malolactic fermentation is desired.

3. The method of claim 1 wherein the analysis of the wine sample is for measuring the malic acid level of wine that is undergoing malolactic fermentation which includes the steps of

15 i) diluting the wine sample in a ratio of 1:20 if necessary to keep the malic acid concentration of the test sample in the range of zero to 500 mg/L;

ii) squeezing a sampler bulb;

iii) dipping the tip of the sampler tip into wine;

iv) releasing the bulb to aspirate sample;

20 v) transferring the sample to an adsorptive layer on the back of a test strip by squeezing the sampler bulb;

vi) allowing a sample droplet to absorb into adsorptive layer after which the sample proceeds downward through an interference removal pad, then continues to a reagent test pad where it reacts with at least one colorimetric indicating material;

25 vii) waiting about four minutes for color development;

viii) viewing the color developed;

ix) determining the malic acid level by comparing the developed color to a standard color chart provided, making corrections to compensate for any dilution that was done;

x) maximizing the quality of wine if low levels of malic acid are indicated by the developed color by adding preservative levels of sulfur dioxide to prevent the growth of undesired bacteria.

5 4. The method of claim 1 wherein the analysis of the wine sample is for measuring the levels of residual yeast-fermentable sugar in wine including the steps of

i) diluting the wine sample in a ratio of 1:20 if necessary to keep the concentration of the test sample in the range of from zero to 2000 mg/L;

ii) squeezing a sampler bulb;

10 iii) dipping the tip of the sampler tip into wine;

iv) releasing the bulb to aspirate sample;

v) transferring the sample to an adsorptive layer on the back of a test strip by squeezing the sampler bulb;

15 vi) allowing a sample droplet to absorb into adsorptive layer after which the sample proceeds downward through an interference removal pad, then continues to a reagent test pad where it reacts with at least one colorimetric indicating material;

vii) waiting about two minutes for color development;

viii) viewing the color developed ;

20 ix) determining the residual yeast-fermentable sugar level by comparing the developed color to a standard color chart provided, making corrections to compensate for any dilution that was done;

x) maximizing the quality of wine by adding preservative levels of sulfur dioxide as soon as the yeast-fermentable sugar concentration has reached desired levels as indicated by the developed color.

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5. The method of claim 1 wherein the analysis of the wine sample of for the measuring of pH including the steps of

i) squeezing a sampler bulb;

ii) dipping the tip of the sampler tip into wine;

30 iii) releasing the bulb to aspirate sample;

iv) transferring the sample to an adsorptive layer on back of a test strip by squeezing the sampler bulb;

v) allowing a sample droplet to absorb into adsorptive layer after which the sample proceeds downward through an interference removal pad, then continues to a reagent test pad where it interacts with at least one colorimetric indicating material;

vi) waiting about three minutes for color development;

vii) determining the pH by comparing the developed color to a standard color chart provided.

viii. maximizing wine quality by ensuring wine is at the pH level for optimum flavor as indicated by the developed color, or by adjusting pH levels until the desired range has been attained.

6. The method of claim 1 wherein the observation of the developed color is performed by comparing the developed color with that of a standard color chart and without the need for instrumental color intensity measurement

7. A testing device for the colorimetric determination of wine samples comprising a polymeric, non-reactive support element with three distinct layers of varying lengths and an opening through which the reagent test pad can be viewed, in order

a) an adsorptive top layer of a non-woven fabric which facilitates wetting of a plurality of layers below it; said layers prepared in varying lengths wherein each layer is longer than the one below it and each is independently attached to the support element by adhesive;

b) a reagent test pad that comprises a small-porosity membrane

c) an interference removal pad that exhibits adsorptive properties towards anthocyanin-based substances in wine.

8. The device of claim 7 wherein the reagent test pad is comprised of materials selected from the group consisting of polysulfones, polyamides, and filter paper.

9. The device of claim 7 wherein the interference removal pad is selected from the group consisting of polyamides and membranes produced from unmodified amphoteric nylon 6,6, and possessing an equivalent number of amino and carboxyl end groups and having a porosity ranging from about 0.1 to 0.45 microns.

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10. The device of claim 7 wherein the wine samples are tested for substances selected from the group consisting of pH, malic acid, lactic acid, residual yeast-fermentable sugar, acetaldehyde, acetic acid, ammonia, citric acid, hydrogen sulfide, potassium, alcohol, titratable acidity, harvest sugar, amino nitrogen, carbon dioxide, tannins and sulfur dioxide.

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11. The device of claim 7 wherein the wine sample is first deposited by droplets onto the top adsorptive layer, after which it proceeds to the next layer which is the interference removal pad whereby anthocyanin-based substances are trapped, after which it proceeds to the next layer which is the reagent test pad where colorimetric chemical reactions occur after a predetermined time period indicating the amount of lactic acid, malic acid, residual yeast-fermentable sugar, and pH of the sample.

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12. A test kit for the colorimetric determination of wine samples comprising

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- a) a plurality of multi-layer disposable test strips;
- b) a plurality of disposable sampler devices,
- c) a plurality of instructions for use;
- d) a plurality color charts and written explanations of the test results

which test kit components produce values for the determination of tests selected from

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the group consisting of malic acid, lactic acid, residual yeast-fermentable sugar, and pH.

13. The test kit of claim 12 wherein the multi-layer disposable test strip is comprised of a polymeric, non-reactive support element with three distinct layers of varying lengths and an opening through which the reagent test pad can be viewed;

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- a) an adsorptive top layer of a non-woven fabric which facilitates wetting of a plurality of layers below it, said layers made in varying lengths wherein each layer is

longer than the one below it and each is independently attached to the support element by adhesive.

b) a reagent test pad that comprises a small-porosity membrane; and

c) an interference removal pad that exhibits adsorptive properties towards

5 anthocyanin-based substances in wine.

14. The test kit of claim 12 wherein the sampler devices are disposable pipettes with volume ranging from about 20 to about 250 microliters.

10 15. The test kit of claim 13 wherein the interference removal pad is comprised of materials selected from the group consisting of membranes produced from unmodified amphoteric nylon 6,6, and possessing an equivalent number of amino and carboxyl end groups and having a porosity ranging from about 0.1 to 0.45 microns.

15 16. The test kit of claim 15 wherein the an interference removal pad that exhibits adsorptive properties towards anthocyanin-based substances in wine;

17. The test kit of claim 12 wherein the data analyzed are selected from the group consisting of pH, malic acid level, lactic acid level, titratable acidity, harvest sugar,  
20 residual yeast-fermentable sugar, sulfur dioxide, ammonia, amino nitrogen, target alcohol levels, acetic acid, carbon dioxide, hydrogen sulfide, acetaldehyde, citric acid, and tannins.